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ATTACHMENT 1

tea: Comparison of black and green teas

Haytowitz¹, J.M. Holden¹, J. Dwyer², J. Peterson², S.E. Gebhardt¹,

Ridge³, S. Agarwal⁴, and D.A. Balentine⁴

ISDA, Beltsville, MD 20705, ²Jean Mayer USDA HNRC on Aging and Tufts University

I Nutrition, Boston, MA, ³General Mills, Minneapolis, MN,

⁴Foodstuffs North America, Englewood Cliffs, NJ



Agricultural
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Table 1. Flavonoid content of black tea

Tea, black, brewed	Substances	Flavonoids	Mean	SEM	N	Min	Max	SD
Flavan-3-ols								
-	Epicatechin	1.40	0.12	69	0.33	4.79	B	
-	Epicatechin gallate	2.34	0.18	77	0.40	6.74	B	
-	Epigallocatechin gallate	7.15	0.43	77	2.00	18.98	B	
-	Epigallocatechin	0.23	0.00	77	0.20	21.04	B	
-	Epicatechin gallate	10.31	0.58	77	1.14	40.68	B	
-	Gallocatechin	1.26	0.23	16	0.56	2.7	A	
-	Theaflavin	1.58	0.18	38	0.35	5.27	B	
-	Theaflavin-3-gallate	1.75	0.21	39	0.08	4.08	B	
-	Theaflavin-3-gallate	1.51	0.18	39	0.12	4.13	B	
-	Theaflavin-3-gallate	1.25	0.14	39	0.06	3.10	B	
-	Theaflavins	2.44	7.81	11	48.29	128.60	B	
Flavanols								
-	Kaempferol	1.20	0.09	44	0.25	2.41	B	
-	Mycetin	0.46	0.04	33	0.17	0.70	A	
-	Quercetin	2.18	0.20	44	0.41	4.75	B	
Tea, black, brewed, decaffeinated								
-	Substances	Flavonoids	Mean	SEM	N	Min	Max	SD
-	Flavan-3-ols	Epicatechin	0.49	0.12	4	0.34	0.67	B
-	Epicatechin gallate	0.64	0.38	4	0.26	1.71	B	
-	Epigallocatechin	0.55	0.16	4	0.19	1.01	B	
-	Epigallocatechin gallate	1.01	0.48	4	0.40	2.45	B	
-	Theaflavin	0.31	0.10	4	0.08	0.66	B	
-	Theaflavin-3-gallate	0.42	0.37	4	0.00	1.02	B	
-	Theaflavin-3-gallate	0.18	0.15	4	0.00	0.61	B	
-	Theaflavin-3-gallate	0.41	0.24	4	0.11	1.14	B	
-	Theaflavins	49.03	1.13	4	48.05	51.52	B	
Flavanols								
-	Kaempferol	1.22	0.20	4	1.00	1.84	B	
-	Mycetin	0.33	0.05	4	0.26	0.49	B	
-	Quercetin	2.94	0.29	4	2.43	3.20	B	
Tea, black, ready-to-drink, plain and flavored								
-	Substances	Flavonoids	Mean	SEM	N	Min	Max	SD
-	Flavan-3-ols	Epicatechin	0.49	0.15	17	0.03	2.65	A
-	Epicatechin gallate	0.51	0.09	17	0.09	0.77	A	
-	Epigallocatechin	0.05	0.42	17	0.00	7.45	A	
-	Epigallocatechin gallate	0.11	0.19	17	0.00	3.11	A	
-	Theaflavin	0.05	0.03	17	0.00	0.18	A	
-	Theaflavin-3-gallate	0.04	0.02	17	0.00	0.33	A	
-	Theaflavin-3-gallate	0.02	0.01	17	0.00	0.09	A	
-	Theaflavin-3-gallate	0.00	0.02	17	0.00	0.27	A	
-	Theaflavins	25.48	3.17	17	7.00	56.76	A	
Flavanols								
-	Kaempferol	0.69	0.08	17	0.14	1.23	A	
-	Mycetin	0.67	0.09	17	0.11	1.45	A	
-	Quercetin	0.74	0.15	17	0.20	2.10	B	

Table 2. Flavonoid content of green tea

Tea, green, brewed	Substances	Flavonoids	Mean	SEM	N	Min	Max	SD
Flavan-3-ols								
-	Catechin	2.85	1.71	38	0.00	44.40	H	
-	Epicatechin	0.68	0.63	62	1.80	26.00	B	
-	Epicatechin gallate	21.96	3.09	52	1.00	26.00	H	
-	Epigallocatechin	18.72	1.78	52	1.00	54.40	B	
-	Epigallocatechin gallate	88.32	7.29	82	18.13	204.03	B	
-	Theaflavin	0.05	0.01	4	0.02	0.03	B	
-	Theaflavin-3-gallate	0.01	0.01	4	0.00	0.03	B	
-	Theaflavin-3-gallate	0.01	0.01	4	0.00	0.01	B	
-	Theaflavins-3-gallate	0.01	0.01	4	0.00	0.03	B	
-	Theaflavins	1.03	1.00	4	0.00	4.30	B	
Flavanols								
-	Kaempferol	1.42	0.22	12	0.87	2.33	B	
-	Mycetin	1.10	0.11	12	0.62	1.68	B	
-	Quercetin	2.69	0.26	12	1.40	4.10	B	

Table 3. Total flavonoid subclasses for tea

Tea Product	Catchins, Total	Theaflavins, Total	Thearubigins, Total	Flavonols, Total
Black, dry, leaves	300.63	603.28	5918.94	371.27
Black, decaffeinated	242.30	123.10	412.61	398.48
Black, brewed	34.26	6.08	73.44	3.85
Green, dry, leaves	17515.58	6.78	131.91	515.70
Green, decaffeinated	1942.16	26.70	972.52	444.85
Green, brewed	132.12	0.07	1.08	112.11
RTD ^a black	2.05	0.17	25.49	2.27
RTD, green	11.88	0.04	0.0	1.58
RTD made with powder	2.02	0.03	23.85	1.40
Ready-to-drink				

Results

Literature Review:

- Approximately 79 articles had descriptions about analysis of tea and flavonoids
- Approximately 25 articles had analytical quantitative data
- 14 articles had acceptable analytical data
- Additional analytical data were provided by Unilever Foods

Discussion:

- Dry green tea contains mostly catechins (3 times that of black dry tea)
- Dry black tea contains 89 times more theaflavins and end 45 times more thearubigins compared to dry green tea.
- Quercetin is the prominent flavonol in tea.
- Decaffeination reduces catechins in both dry black (14 times) and dry green (3 times) tea considerably.
- Decaffeination or fermentation does not affect flavonol levels
- All ready to drink tea contain 5% to 10% of the flavonols compared to their respective brewed teas.

Database:

- Table sorted by tea and flavonoid class
- Confidence code and number of each aggregated flavonoid provided for each code
- Database is available on NDL's Web site: <http://www.nal.usda.gov/mtoadcomp>

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